Dynamic Interaction of Unbalanced Masses Spinning in Vacuum*

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This paper presents results of experimental research in vacuum into interactions between spinning disks that are close together but not mechanically linked. The research demonstrates that, during co-rotation at large angular velocities, there are interaction forces between the disks, causing precession of the disk spins and elastic deformation of the disk surfaces, in the form of a screw twisting. Thus there is energy transfer from one spinning disk to another initially immobile disk, leading it to gyration, and in their simultaneous gyration, a cross-inhibiting action, and heating of the disks.

Equipment Inventory

The experiments used a device consisting of two direct-current electro-motors, 1 and 2, of serial number 14FT2c, with electromagnetic braking by steel plates 3 and 4, of thickness 18 mm (Fig. 1).

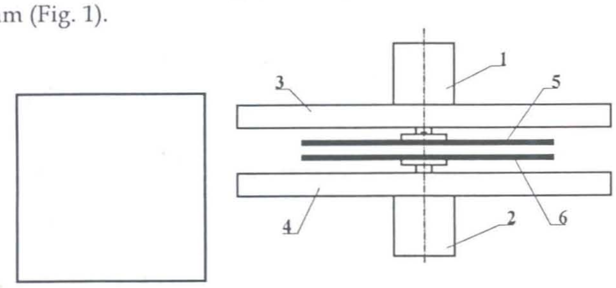
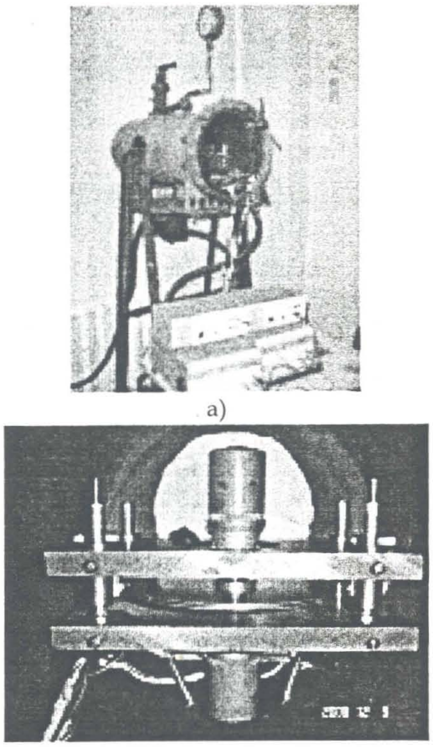


Figure 1. Diagram of the device for examination of dynamic effects

Rigidly anchored on the flanges of the turns of the electro-motors were disks, 5 and 6, of diameter 165 mm and thickness 0.9 mm, type AMr3M, made of an aluminum alloy. (In several cases one disk made of wood was used). The electro-motors were connected to direct-current power supplies, B5-48, outside of the cabinet, allowed to maintain a given stable voltage. Separate power supplies were used for inserts and cutouts of the electromagnetic brakes for the electro-motors.

The distance between disks was set to accommodate parallel travel on four steel columns for the fastening plates of the electro-motors, which were subsequently fixed rigidly. The distance from the disks up to the plates was not less than 20 mm. The greatest possible parallelism and balance between the disks was provided. In the experiment, a deliberate skew of the axes of the disks with respect to the axes of their electro-motors was set, creating upon gyration of the disks a variable quadrupole moment. The initial positive allowance between disks was set from 1 up to 6 mm, and more. The chance of mechanical contact between disks during gyration due to their imbalance was thus precluded.

The device was set up and rigidly fixed in a vacuum chamber with inner diameter of 300 mm and wall thickness of 15 mm (Fig. 2). The 'roughing-down' pump, evacuated air from the cabinet to a residual pressure of approximately 1 Pa.



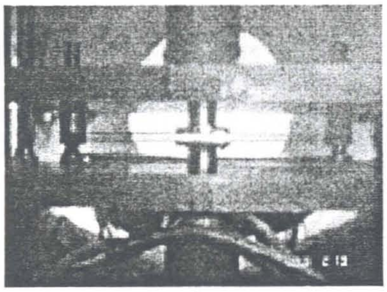
a)

b)

Figure 2. General views of the external equipment and the device in the vacuum chamber.

Experiments

In the first series of experiments, the supply voltage simultaneously acted on both of the electro-motors. With an initial positive allowance between disks on the order of 1 to 3 mm (Fig. 3a), and a simultaneous applied voltage of 30 V on both electro-motors for their gyration in opposite directions (opposing rotation), rotation was ramped up to a peak frequency on the order of 100 to 120 per second (Fig. 3b). Then periodically a strong vibration of one disk (Fig. 3c), or simultaneously both disks (Fig. 3d), began. The oscillation frequency of disks was on the order of 10-20 cycles per second (cps). During the moments of origination of vibration, the spin velocity of the disks sharply decreased, approximately by half (to 50-60 cps).



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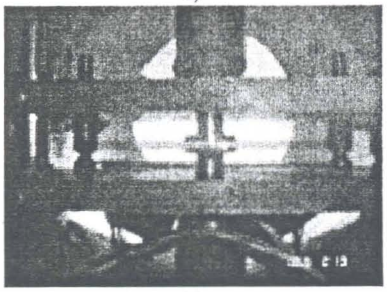

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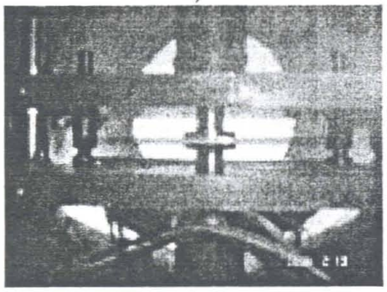

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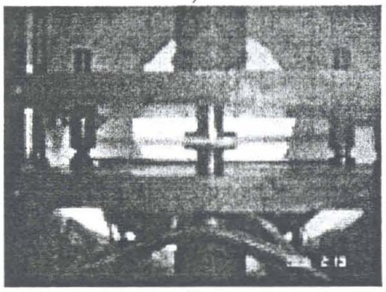
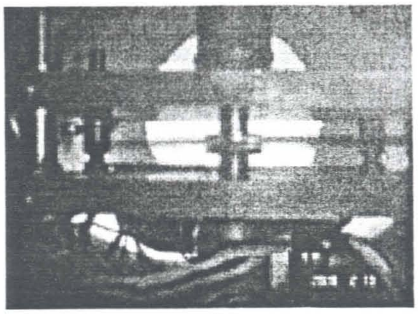


d)

Figure 3. Excitation of amplitude vibration of disks under simultaneous, opposite gyration in a vacuum chamber

Thus significant warping of the surfaces of the disks, *i.e.* their elastic deformation (Figs. 4), was observed. Oscillations of one disk were chaotic relative to the other. The positive allowance between the surfaces of the disks in various bands was also variable in time.

Mechanical contact between the disks did not occur, even in the case of just 1 mm initial positive allowance between them. The disks acted as though they repelled each other, as is visible in the photos, and each of the disks prolonged gyration in their own direction. At the termination of vibration, the rotation frequency of the disks again increased. The process repeated with some periodicity.



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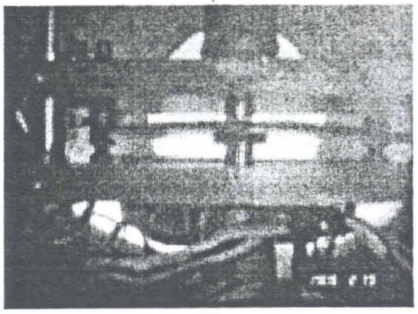
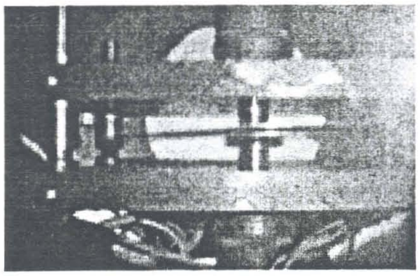


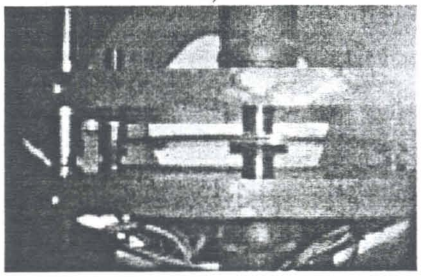
b)

Figure 4. A warpage of surfaces of disks during maximum amplitude vibration.

At some moments of time, chaotic oscillations of the disks transformed into a rather stable shape - the screw twisting of the disks spun with frequencies on the order of 1 to 3 cycles per second (Fig. 5).



a)



b)

Figure 5. A tilting and a twisting of surfaces of disks during simultaneous colliding gyration in vacuum

In this case, there was a synchronous contortion of the planes of both disks. In the photos taken, and in the delayed scanning of a video recording of the process, the surface of the deformed disks apparently remained practically equidistant. That is, disks with surfaces of a spiral shape, being spun in the opposite sense with a rotation frequency on the order of 90 to 100 cycles per second, flow around each other, not making mechanical contact. The wave mechanical and elastic deformation of the disks moves on their surface with angular velocity of the same order as the angular velocity of gyration of the disks. Thus gyration of the screw twisting was observed to be synchronous with the gyrations of the disk having the higher rotation frequency.

When the disks were purposely unbalanced by setting a small skew to the axes of disks and the axes of their electro-motors, that unbalance promoted their intense vibration. The above-described interaction of the disks, *i.e.* excitation of vibration, and then origination of a bending wave, were observed at positive allowances between them of up to 3 mm. In experiments under the same conditions, but without vacuum (*i.e.* at normal atmospheric pressure in the cabinet), these effects were not manifested. The strong vibration of disks was not energized, and the bending wave was not observed, even at the initial positive allowance between disks of less than 1 mm.

Upon cut-out of one of the electro-motors (for gyration in vacuum), and shut-down of its disk, the second electro-motor went to a peak rate on the order of 180 to 200 cycles per second. Upon restarting the first electro-motor, the rotation frequency of the second electro-motor again decreased. The rotation frequency of both disks again reached nearly 90 to 100 cycles per second. Thus, given repeated experiments in vacuum, it is confirmed that during co-rotation, strong cross inhibition action between disks occurs.

Thus it was demonstrated in this case that, after long-term (2 to 3 minutes) simultaneous non-contact gyration and interaction, the disks heated up to temperature 65 to 70 °C. With more long-term continuous operation of the device (5 to 7 minutes), the reheat temperature of the disks attained 80 to 90°C. Measurements of the temperatures of the disks were taken 1 to 2 minutes after stopping the disks and bearings of the vacuum chamber.

With simultaneous application of voltage 30 V on both of the electro-motors for the spin of their disks in one direction (parallel rotation), and after the complete acceleration, only the strong vibration of both disks and their cross inhibiting action was observed. Strain in the form of bending of the plane of the disk was not observed.

The rotation frequency of the electro-motors here was also considerably below peak. During simultaneous gyration in this case, the disks heated up to temperatures of 50-60°C. Upon cut-out of one of their electro-motors, the second electro-motor went to the peak rate. Upon restarting of the first electro-motor, all effects completely repeated.

If one electro-motor was disconnected and braked, then after the delivery to the second electro-motor of a voltage 30 V and the full development of the small vibration of the disk had begun, a small vibration of the stationary disk was periodically energized. At the start of vibration of the stationary disk, an appreciable decrease in the rotation rate of the spinning disk was observed.

However, even after the long-term operation of the device, heating of the disks was not observed in this case. Thus, as a result of repeated experiments it is concluded that the heating of the disks occurs only with their simultaneous gyration in vacuum. The heating of the disks was a consequence of their non-contact interaction and cross non-contact inhibiting action.

In the second series of experiments, the supply voltage affected only one drive; the second was disconnected from the feed, but not braked.

It was observed that, in vacuum, if one electro-motor had been disconnected, but not braked, then after delivery on the second (driving) electromotor of a voltage 30 V, its full rotation and the forced gyration of the first disk, together with turning of its electromotor, began. It was revealed that the effect of excitation of the forced gyration and the rotation frequency, with other things being equal, depends on the degree of dynamic balance of the disks.

Experiments have shown that, with a sufficient degree of balance between the disks, and without their vibration at the peak untwisting, at a positive allowance between disks of more than 2 to 3 mm, forced gyration of the driven disk was not energized.

At a positive allowance between disks of 1.0-1.5 mm, at the peak acceleration of the leading disk, slow rotational displacement of the driven disk with a rotation frequency less than 0.05 1/s was observed. Upon origination of vibration of the leading disk gyration of a driven disk with a rotation frequency of 5 to 10 cycles per second began. If vibration of the leading disk increased, the rotation frequency of the driven disk was incremented by up to 20 to 30 cycles per second.

At the same time, it was detected that with a rather small dynamic imbalance of the disks, forced gyrations of disks were energized at a positive allowance between the disks of up to 3 mm. The frequency of the forced gyration, with other things being equal, depended on the size of the initial positive allowance between the disks, the rotation frequency above being less. With a positive allowance between disks of 1 mm, and with the supply voltage of the leading electromotor at 30 V, the frequency of the forced gyration of the driven disk attained 40-50 cycles per sec at a rotation frequency of the driving disk approximately 130-150 cycles per sec.

With a positive allowance between disks of more than 4 mm even a strong vibration of the disks in the first experiment did not lead to excitation of any forced gyration of the driven disk.

Thus, power action in vacuum from a driving disk spinning with a high speed on a mechanically uncoupled, initially immobile, driven disk, gyration was observed.

The magnitude of the torsional moment created in it is sufficient to spin the electromotor together with a driven disk. Counteraction to this torsional moment, for a shut-down of the forced gyration of the disk, demanded delivery from the voltage on the electromotor of the driving disk, to the corresponding driven electro-motor of a voltage equal to 0.2-0.8, depending on the positive allowance between the disks and the degrees of their equalization. At a supply voltage to the leading electromotor of 30 V, for a shut-down of the forced gyration of the driven electromotor at a positive allowance between disks of 1.5 mm, delivery to it of voltages for the colliding gyration making 12 to 18 V was required, and at a positive allowance between the disks of 3 to 5 mm, 11 V. With a further magnification of the supply voltage of the driven electromotor, the disk began gyration in the direction opposite to the leading disk.

The same experiments have been conducted without vacuum (*i.e.* at normal atmospheric pressure in the cabinet). At the same supply voltage to the electro-motors, the velocity of gyration of the disks was a little lower. Thus vibration of the disks did not originate. The forced gyration of the driven disk was practically not energized, even at a positive allowance between the disks less than 1 mm. Thus slow rotational displacement of the driven disk with a rotation frequency less than 0.1 to 0.3 cycles per second, *i.e.* an order of magnitude below that in the case of forced gyration of the conducted disk in vacuum, was observed.

Thus, as a result of the many repeated experiments set forth above, it is established that the forced gyration of an initially immobile disk is caused by non-contact power transmitted in vacuum from a spinning disk. Thus the initiation of precession or vibration of the disk precedes the onset of forced gyration. Without empty space (in the presence of air in the cabinet), the forced gyration of an initially immobile disk by a nearby disk spinning at a high speed is practically not energized.

Disks have been manufactured of a non-magnetic material and, therefore other known mechanisms of interaction (Barnet effect, *etc.*) are excluded.

As the driven disk came to gyration, precession was observed, which means that the driven disk gained energy from the driving disk, and since the driving disk, at the stable given supply voltage it the electro-motor, was braked at gyration conducted, that means it donated to the driven disk a part of the energy of gyration. The air medium interfered with this process.

Deductions

Proceeding from the analysis of results of the above experiments, it is possible to ascertain the following:

1. The energy transfer {power transmission} in vacuum from one (leading) disk spun with large angular velocity, to second (conducted) initially stationary disk, mechanically unconnected with it is observationally established. First the precession (or vibration) of a driven disk, and then its spin beside the spin of a leading disk, is observed. It is established that the initial precession of a disk, or its vibration, is a necessary requirement for intensification of its forced gyrations.

2. The considerable power action in vacuum from a leading disk spun with a high speed on a conducted disk not mechanically linked to it is observationally established. The magnitude of the torsional moment created by this is great enough to spin the electromotor together with a conducted disk. With small positive allowances between disks, counteraction to this torsional moment demands delivery on its electromotor of a voltage quantity 0.3 to 0.8 V from the voltage on the electromotor of the leading disk, depending on the quantity of the positive allowance between disks and the dynamic imbalance of the leading disk.

3. At simultaneous high-speed gyration of disks, there is their non-contact power interacting, leading the strong vibration and joint strain of disks - to a bending of the planes of the disks.

4. Power interacting and cross-inhibiting action of disks at simultaneous long-term non-contact gyration in vacuum leads to a significant heating (50 to 70°C). In the case of spinning only one disk, the heating was not observed.

5. All the above-stated effects are manifested only with spinning of the disks in vacuum. With spinning of the disks at normal atmospheric pressure, vibration of the disks with large amplitude originates, the twisting of planes of disks during their simultaneous colliding gyration does not occur. Also in air the forced gyration of one disk is not energized at the peak spin velocity of the second disk. The small effect of excitation of the forced gyration with frequency less than 0.05 to 0.1 cycles per second was observed in air only with a positive allowance between disks of less than 1 mm.

Correspondence

Incompatibility of General and Special Relativities

continued from p. 2

$$M^*c^2 + M^*\Phi = Mc^2 + M\Phi + h\nu_g \quad . \tag{3}$$

This equation (following from experiment) expresses the law of energy conservation for photon emission in a gravitational field.

Experiment *vs.* GR

However, according to GR, the photon potential energy $h\nu_g$, Φ / c^2 is not taken in to account on the right in Eq. (3). Adding it, we obtain

$$M^*c^2(1+\Phi/c^2) = Mc^2(1+\Phi/c^2) + h\nu_g(1+\Phi/c^2) \quad . \tag{4}$$

After removing the common factor $(1+\Phi/c^2)$, we have

$$M^*c^2 = Mc^2 + h\nu_g \quad . \tag{5}$$

Comparing with Eq. (2), we conclude that $\nu_g = \nu$, *i.e.* according to GR (see, *e.g.* [11]), the frequency of quantum standards does not change in a gravitational field. But this means that the atomic clock rate must not change either, and this contradicts directly the results of the experiments [7-9]. In this connection, see also [12, 13].

Relativistic Gravidynamics Conquers GR [14]

Since Eq. (3) following from experiment is a relativistic one, it means that Nature shows us the way of relativistic generalization of Newton's gravitation theory. For this, it should be taken into account only that the energy is the time component of a 4-vector. The only relativistic formula for gravitational potential energy admissible by Eq. (3) the takes the form

$$p_g^0 c = m\Phi^0 \quad , \tag{6}$$

from which it follows that the mass retains the role of gravitational charge (as in Newton's theory). On the other hand, it remains a 4-scalar (Lorentzian invariant) in accord with special relativity theory. The potential gravitational field is described by a 4-vector the time component of which is Newton's potential. Thus Eqs. (3) and (6) serve as the basis of the Lorentz-covariant theory of gravity [15] that was called 'relativistic gravidynamics' for its likeness with electrodynamics.

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